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The Interrelationship between Social Media Use, Mental Health, and Science Learning Among Middle School Students: A Systematic Review

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ABSTRACT

The study was conducted to review peer-reviewed articles on the balance between social media usage, mental health, and science learning outcomes of middle-level learners. This review employed the PRISMA 2020 guidelines. The review found that social media is neither uniformly harmful nor beneficial. Its impact on middle-level learners' mental health and science education is shaped by the type of engagement, developmental stage, gender, and surrounding support. The study further pinpointed several strategies that would be effective for ensuring responsible and healthy mental use of social media among middle-level learners, aiming at enhancing their science learning goals. We recommend that tasks and assignments given by teachers that encourage learners to use social media be restricted to content that is appropriate for their age group. ~~Aids that promote and encourage learners to move away from given tasks on websites must be removed.~~

INTRODUCTION

Social media has rapidly become a near-ubiquitous presence in adolescents' lives, raising important questions for educators and mental health professionals alike. Globally and across contexts, young people's engagement with platforms like Instagram, TikTok, and YouTube is at an all-time high. For example, in the United States, 95% of teenagers report using social media and nearly half go online "almost constantly," a pattern mirrored in many other countries (Anderson & Jiang, 2018). This unprecedented connectivity offers both opportunities and risks. On one hand, social media can facilitate peer interaction, creative expression, and access to information; on the other, researchers have documented associations between heavy social media use and adolescent mental health challenges, including depression, anxiety, and low self-esteem (Kelly *et al.,* 2018; Ivie *et al.,* 2020; Woods & Scott, 2016). International health authorities have begun to treat youth mental health as a global priority (Patel *et al.,* 2018). The American Psychological Association (2023) recently issued an advisory on adolescent social media use, underscoring concerns that excessive or unregulated use may harm psychological well-being during this vulnerable developmental stage. At the same time, not all effects are adverse: the literature also points to potential benefits of moderated use, such as enhanced social support and educational enrichment (O'Reilly *et al.,* 2018; Ridout & Campbell, 2018). These mixed findings highlight the context-dependent nature of social media's impact. Understanding when and how social media helps or hinders adolescents has thus become important.

Amid this broader debate, early adolescence, which is roughly the middle school years (ages 11-14) deserves special attention. Middle school learners represent a critical juncture in both psychological development and academic trajectory. During these years, youth face rapid changes in identity formation, peer norms, and emotional regulation, even as many are first introduced to social media. Recent surveys indicate that substantial numbers of middle school students begin using social media in late childhood (some by age 9) and often with minimal supervision or guidance (Martin *et al.,* 2018). This raise concerns as young adolescents may lack the digital literacy and coping skills to navigate online difficulties, and thus, making them particularly susceptible to issues like cyberbullying and social comparison (Kowalski & Limber, 2007; Valkenburg *et al.,* 2021). Such mental health stressors can have direct repercussions on academic life. A growing body of evidence confirms that psychological well-being is tightly interwoven with school outcomes; symptoms of depression or anxiety can decrease motivation, concentration, and classroom engagement (Gupta *et al.,* 2022). In middle school science classes, where students are expected to build foundational knowledge and enthusiasm for STEM, emotional distress can be especially detrimental. Indeed, the middle school period is often seen as pivotal for sustaining interest in science. If social media influences how students feel about themselves and interact with peers, it may indirectly shape how well they learn or whether they embrace subjects like

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science. However, little is known about these specific intersections such as how an eighth-grader's nightly social media routine affects their mental health, and in turn, their readiness to learn science the next day.

Conceptually, this study is grounded in Bandura's Social Learning Theory (1977) as a lens to understand social media's dual influence on mental health and learning. Social Learning Theory posits that individuals learn not only through direct experience but also by observing others, whether those models are live peers, authority figures, or symbolic personas in media. Adolescents on social media are constantly observing and imitating, often internalizing behaviors, values, and emotional responses from their online networks (Bandura, 1977). Through features like followings, likes, and comments, social platforms provide a continuous stream of models for behavior and attitudes. These models can shape adolescents' well-being and academic orientations by example: for instance, when a student sees a peer rewarded with praise for sharing a science experiment or receiving good grades, it may reinforce the student's own academic aspirations. Likewise, witnessing friends engage positively with educational science content (such as fun chemistry demonstrations on TikTok) could spark curiosity and learning. Prior research has highlighted that social media integrates multiple forms of observational learning, combining direct peer interaction, symbolic content (images, videos), and even instructional material, all within one environment (Bajcar & Bąbel, 2018). From a Social Learning Theory perspective, this means that social media can function as an extended classroom, offering informal avenues to watch, listen, and learn science-related information beyond school walls. Through the core mechanisms Bandura described (attention, retention, reproduction, and motivation), adolescents might convert what they see online into new knowledge or skills. For example, paying attention to a YouTube video of a science experiment, remembering its steps, trying to replicate it, and feeling motivated by peer feedback are all steps that mirror classroom learning processes.

At the same time, Social Learning Theory also warns of a double-edged sword. The same observational processes that facilitate learning can also transmit maladaptive behaviors or beliefs. In the context of social media, adolescents may observe harmful models such as peers glorifying risk-taking, influencers promoting unhealthy body images, or aggressive behaviors going unchecked, and potentially imitate these to the detriment of their mental health (Cherry, 2024). The theory suggests that behaviors seen to be rewarded (even implicitly, via attention or "likes" in the case of social media) are more likely to be copied, whereas those met with negative consequences are avoided. Thus, if dangerous online interactions (like cyberbullying or the spread of misinformation) are prevalent in a student's social media feed, they may become normalized and impact that student's own behavior and emotional state. In a school setting, this could translate to distraction, decreased self-esteem, or fear that undermines participation. Social Learning Theory helps explain how social media's content and social dynamics might ripple into the classroom. An adolescent who observes peers receiving social rewards for academic disengagement or hostile behavior could internalize attitudes that inhibit their own academic effort. Conversely, one who observes positive reinforcement for scientific curiosity or kindness online may be more likely to emulate those constructive behaviors. Thus, social media can either bolster or undermine both mental health and academic motivation, depending on what adolescents observe and experience. This theoretical framework therefore underpins our review with emphasizes identifying conditions under which social media supports, rather than disrupts, healthy development and education (Bandura, 1977; Mussadiq, 2024).

Despite the theoretical plausibility of these connections, there are significant gaps in the existing research. Empirically, prior studies have tended to investigate social media's impacts on adolescent mental health in general (Khalaf *et al.,* 2023; Beyens *et al.,* 2020) or to explore educational uses of social media in isolation (Akgunduz & Akinoglu, 2016; Lundgren *et al.,* 2022). Very few have explicitly examined how these domains intersect, specifically, how social media use might simultaneously shape mental health and academic outcomes in a subject-specific context like science learning for early adolescents. Notably, middle school learners have been under-represented in research to date. Many large-scale surveys and psychological studies on social media focus on older teens or aggregate "adolescents" as a broad category (Twenge *et al.,* 2018; Vannucci *et al.,* 2017), leaving the unique experiences of younger adolescents less understood. Education technology research, for its part, has documented innovative ways that social media can support learning for example, through science project collaboration on Facebook or exposure to informal science content on Instagram (Rap & Blonder, 2016; Essig *et al.,* 2020). However, these studies often do not address students' mental health or well-being, thus, treating academic engagement as if it were independent of psychological context. Conceptually, we lack an integrated understanding of how an adolescent's online social experiences (positive or negative) might translate into cognitive and emotional readiness to learn. In other words, the field has not fully connected the dots between social media-induced mental health effects and classroom learning processes. Addressing this gap requires bridging insights from social media usage, mental health, a synthesis that is currently missing in the literature.

Given these gaps, a systematic review is warranted to bring together the fragmented findings and provide a more comprehensive picture. Systematic reviews offer a rigorous method to aggregate and evaluate evidence across studies in a transparent, replicable manner (Petrosino *et al.,* 2001). To date, some systematic reviews have been conducted on related subtopics. For instance,

syntheses of social media's overall effect on youth mental health (Khalaf *et al.,* 2023) and reviews of strategies for positive youth online engagement through social-emotional learning (Setia *et al.,* 2024). No review, however, has specifically focused on the nexus of social media use, mental health, and science education outcomes among middle school students. This is a notable omission, considering the importance of early adolescent well-being for long-term academic success and the rising calls to integrate technology into STEM education. By systematically examining studies at this intersection, the present review aims to fill this gap.

The rationale for our review is therefore twofold. First, we seek to clarify the evidence: What does the current research collectively tell us about how social media use impacts middle school learners' mental health and their learning in science? This includes identifying consistent patterns (e.g., types of social media use that are especially harmful or beneficial) as well as inconsistencies or moderating factors (such as gender, socioeconomic context, or usage intensity). Second, we aim to inform practice and policy. Understanding these dynamics has practical implications for educators, parents, and policymakers who are dealing with how to manage social media in adolescents' lives. Middle school science teachers, for example, report both opportunities and challenges when incorporating social media or observing its effects on students' classroom behavior (Carpenter *et al.,* 2022). However, clear evidence-based guidelines on responsible and developmentally appropriate social media use in educational settings are lacking. By synthesizing existing studies, this review will highlight strategies that enable middle school learners to harness social media in positive ways while mitigating risks to their mental health. To these ends, our present article systematically reviews the literature at this critical intersection, guided by three overarching research:

1. How does social media use impact the mental health of middle school learners?
2. What are the implications of social media use for science learning at this developmental stage?
3. What strategies can promote responsible and mentally healthy use of social media to enhance science learning outcomes for early adolescents?

MATERIALS AND METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines shown in Figure 1.

Search Strategy

A comprehensive literature search was undertaken across multiple peer-reviewed databases, including ERIC (EBSCO), JSTOR, Web of Science, and SpringerLink. The search covered articles published between 2015 and 2025 to capture the most recent and relevant findings. Keyword combinations included: ("social media" OR Facebook OR Twitter OR Instagram OR TikTok OR "online networking") AND ("mental health" OR wellbeing OR "psychological health" OR "emotional health" OR "self-esteem") AND ("science learning outcomes" OR "science academic achievement" OR "science education" OR "learning performance" OR "learning outcomes") AND ("middle school students" OR adolescents OR "young adolescence" OR "junior high" OR "middle level learners" OR "young learners") AND (strategies OR interventions OR programs OR solutions).

Given the limited body of studies directly addressing this research focus, the search parameters were deliberately broad in scope, both in terms of databases and year range, to maximize the identification of relevant literature.

Inclusion and Exclusion Criteria

To ensure rigor, only peer-reviewed studies published between 2015 and 2025 were considered. Eligible studies were required to be written in English and to focus explicitly on learners, with particular relevance to middle school students' social media use and its relationship to mental health. Within this scope, studies were included if they addressed how social media influenced mental well-being, academic engagement, or science learning outcomes, and if they provided insight into strategies for fostering responsible and developmentally appropriate use. Conversely, studies were excluded if they fell outside the designated date range, were published in languages other than English, or lacked a focus on middle school populations. Research that did not address strategies for responsible social media use, or that was not peer-reviewed (e.g., opinion pieces, conference abstracts, non-scholarly reports), was also excluded. These criteria ensured that the final corpus of studies reflected the most relevant, high-quality, and contemporary evidence available.

RESULTS AND DISCUSSION

A total of 233 articles were identified across the four databases (Figure 1). After removing duplicates, 124 remained. Screening by titles and abstracts reduced the pool to 48 articles, of which 32 were excluded after full-text review for focusing solely on high school, college, or university students. Following review by three independent researchers, consensus was reached on the inclusion of 15 articles. Some studies included both high school and middle school participants; however, they were retained where middle school data were explicitly analyzed.

The 15 included studies are summarized in Table 1. These studies varied in design, including cross-sectional surveys, longitudinal analyses, a meta-analysis, and an experience sampling study. Participant numbers ranged from fewer than 120 middle school students to large cohorts of more than 10,000 adolescents. The studies documented a wide range of social media platforms used by adolescents, including Instagram, Snapchat, YouTube, Facebook, Twitter, and emerging digital platforms. Reported daily usage across studies typically ranged between two and five

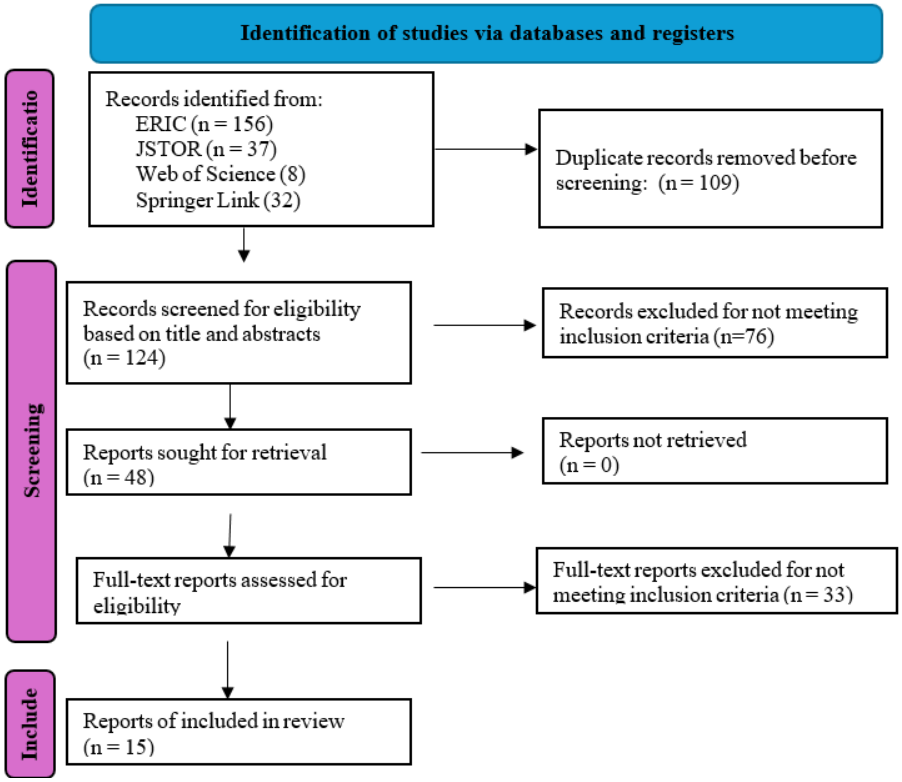

Figure 1: PRISMA flow chart of literature search and screening.

hours or more. Several studies described early adoption of social media, with a proportion of students beginning to use platforms by age nine, often with limited parental monitoring. Patterns of use consistently indicated that adolescents engaged with social media to connect with peers, share content, and observe others' activities.

Across the studies, Frequent or heavy social media use (more than two to five hours daily) correlates with lower self-esteem, increased psychological distress, and unmet mental health needs. Passive browsing leads to negative emotional outcomes, while active use has varied effects based on context. Protective factors include self-efficacy and social support from peers and family. Gender and developmental stage differences were noted, with girls showing stronger links to appearance-related self-esteem and younger adolescents experiencing different effects compared to older peers. Table 1 summarizes each study's details and findings.

Discussion

Table 1: Review of the articles on social media use and mental health of middle school students

No.	Author (Year)	Title	Design	Participants	Findings
1	Martin *et al.* (2018)	Middle School Students' Social Media Use	Cross-sectional survey design	593 middle school students (6th to 8th grade)	The results indicate that 17% of middle school students began using social media at age nine or earlier, with 40% accepting friend requests from unknown individuals and a similar percentage reporting a lack of parental monitoring. The primary reasons for using social media include connecting with friends, sharing pictures, and staying updated on others' activities. The most frequently used platforms are Instagram (27%), SnapChat (25%), and YouTube (25%).

2	Chen *et al.* (2025)	Beyond Likes and Follows: Investigating the Longitudinal Associations between Social Media Rumination and Internalizing Symptoms in Middle School Students	Longitudinal design	126 fifth to seventh-grade students	The Social media ruminations (SMR) revealed a bi-factor structure, comprising SMR related to one's own social media content (SMR-Self) and that related to others' content (SMR-Other). Both types of SMR at time one was positively associated with subsequent anxiety, with no significant gender interactions. Furthermore, SMR-Other, but not SMR-Self, at times one was positively associated with later depression, with no gender interactions observed again. However, it is worth noting that girls reported higher levels of rumination, anxiety, and depression overall
3.	Sampasa-Kanyinga *et al.* (2023)	Heavy social media use and posting regret are associated with lower self-esteem among middle and high school students	Cross-sectional survey	6944 school children (mean age: 15.2±1.8 years)	The proportional odds model showed that middle (OR: 2.36; 95% CI: 1.65–3.36) and high school (OR: 1.72; 95% CI: 1.44–2.06) students with daily social media use of 5 h or more have higher odds of lower self-esteem across the categories of self-esteem. However, daily use of 3 to 4 h was associated with lower self-esteem among middle school students (OR: 1.52; 95% CI: 1.14–2.04), but not among their high school counterparts (OR: 1.13; 95% CI: 0.94–1.35). Heavy social media use and posting regret are associated with lower self-esteem among adolescents, and that younger students could be more vulnerable than their older counterparts
4	Kelly *et al.* (2018)	Social Media Use and Adolescent Mental Health: Findings from the UK Millennium Cohort Study.	Cross sectional analysis	10,904 adolescents, all age 14, from the UK Millennium Cohort Study.	The findings show that heavier social media use is linked to higher depressive symptoms, especially in girls. Key indirect pathways include poor sleep and online harassment, with self-esteem and body image also playing a role. A small direct link remained after accounting for these factors.
5	Ivie *et al.* (2020)	A Meta-Analysis of the Association Between Adolescent Social Media Use and Depressive Symptoms	Meta-Analysis	Adolescents aged 11–18 years	Small but significant positive correlation was found between social media use and depressive symptoms, with high variability across studies.
6	Sampasa-Kanyinga *et al.* (2015)	Frequent Use of Social Networking Sites Is Associated with Poor Psychological Functioning Among Children and Adolescents	Cross-sectional analysis	753 students (55 % female; average age 14.1), grades 7–12, from the 2013 Ontario Student Drug Use and Health Survey in Ottawa, Canada	The findings show that adolescents who used social networking sites more than 2 hours per day were more likely to report poor mental health, psychological distress, suicidal thoughts, and unmet needs for mental health support.

7	Faqihi *et al.* (2024)	Examining the Effects of Social Media on Mental Health Among Adolescents in Saudi Arabia	Cross-sectional online survey	2,856 adolescents (ages 10–24)	Twitter was the most utilized platform at 30.3%. A significant portion of participants (77.4%) aimed to decrease social media use for mental health reasons, with 71% acknowledging disruptions to their sleep patterns, and 66% admitting to staying up late because of it. While the average mental health impact score was low (mean ~37%), older teens (16-24) experienced more negative effects compared to younger adolescents (10-15). Certain demographics, such as married youths and those with only a middle-school education, reported fewer adverse mental health impacts from social media.
8	Durak (2018)	Modeling of variables related to problematic internet usage and problematic social media usage in adolescents	Cross-sectional survey (relational design)	451 (8th –11th grade adolescents)	Moderate levels of "problematic" social media use were observed. Critically, higher problematic use was significantly associated with greater social anxiety, poorer self-regulation, and more academic procrastination. By contrast, neither the amount of time spent on social media nor general Internet addiction showed a significant relationship with problematic social media use in this sample. Academic procrastination had the strongest link to problematic use, suggesting that heavy social media users tend to delay school tasks.
9	Yang (2020)	Effects of Self-efficacy and Self-control on Internet Addiction in Middle School Students: A Social Cognitive Theory-Driven Focus on the Mediating Influence of Social Support	Cross-sectional survey	119 middle-school students in a mid-sized city	Adolescents with higher self-efficacy and better self-control reported significantly lower levels of Internet addiction (i.e. greater confidence in oneself and more discipline correlated with less problematic online use). Additionally, social support from family and peers had a protective effect: it partially mediated the links between those personal traits and addiction, meaning strong support networks helped offset low self-control or efficacy that might otherwise contribute to internet overuse.
10	Sampasa-Kanyinga *et al.* (2019)	Social Media Use, School Connectedness, and Academic Performance Among Adolescents	Cross-sectional analysis of survey data	10,076 adolescents (grades 7–12)	This study identified a threshold effect related to social media use among adolescents. Usage exceeding two hours daily was linked to decreased school connectedness and lower academic performance in middle and high school students. In contrast, moderate use (two hours or fewer) was beneficial for high schoolers. Younger students, particularly in middle school, experienced more negative effects from heavy usage, while older adolescents gained some social benefits from limited use. Overall, excessive social media use appears to pose greater risks to academic success and social integration.

11	Colak *et al.* (2023)	Self-esteem and social media addiction level in adolescents: The mediating role of body image	Cross-sectional design.	204 adolescents; 67 girls and 137 boys; 14 to 18 years	The study found a negative correlation between self-esteem and social media addiction among adolescents, indicating that higher social media addiction is linked to lower self-esteem. Conversely, a positive correlation exists between self-esteem and body image; adolescents with better body image report higher self-esteem. Body image partially mediates the relationship between social media addiction and self-esteem, suggesting that social media negatively impacts body image, thus lowering self-esteem. The researchers noted no significant links between self-esteem and demographic factors like age or parental education, highlighting the stronger influence of social media and body image on self-esteem. Additionally, many participants reported using social media for 3 to 4 hours or more daily, correlating with higher addiction scores, raising concerns about the psychological consequences of excessive engagement.
12	Frison *et al.* (2015)	Exploring the Relationships Between Different Types of Facebook Use, Perceived Online Social Support, and Adolescents' Depressed Mood	Cross-sectional survey design	910 adolescents Gender distribution: 1.9% girls Average age: 15.44 years	Passive Facebook use (browsing profiles) was linked to increased depressed mood among adolescents, especially girls, likely due to more frequent social comparison. Active public Facebook use (posting) was associated with higher depressed mood in boys, while active private use (messaging) showed no direct effect. Perceived online social support mediated these relationships and was linked to reduced depression, with girls benefitting more from supportive interactions. Gender differences were notable: girls engaged in both passive and active use more often and benefited emotionally from online support, while boys were more negatively affected by public posting. These findings highlight the need to consider gender when evaluating the psychological impacts of social media use in adolescents.
13	Orben & Przybylski (2019)	The association between adolescent well-being and digital technology use	Cross-sectional correlational	355,358 adolescents (12–18 years)	The study identified a minor negative association between digital technology use and adolescent psychological well-being, accounting for less than 0.4% of the variation in well-being. This impact was considerably smaller than that of other factors like bullying, which had a 4.3 times stronger negative effect. Utilizing Specification Curve Analysis revealed inconsistent outcomes depending on analytical choices, emphasizing the need for transparency in data analysis. When appropriate controls were added, the negative association diminished further and was often non-significant. The authors conclude that the findings do not warrant substantial policy changes regarding screen time reduction for improving adolescent mental health.

14	Steinsbekk (2020)	The impact of social media use on appearance self-esteem from childhood to adolescence – A 3-wave community study	3-wave longitudinal design	725 children Age range: Data collected at ages 10, 12, and 14	Girls engaging in other-oriented social media activities, such as liking and commenting on posts, showed a significant decline in appearance self-esteem between ages 10 and 14, particularly from 10-12 and 12-14. This decline was not observed in boys, indicating a gender-specific vulnerability. Self-oriented activities like posting did not influence self-esteem or prevent declines caused by other-oriented use. The study utilized the Random Intercept Cross-Lagged Panel Model (RI-CLPM) to strengthen causal inference, revealing that social media use negatively impacts self-esteem, particularly for girls, who face intensified social comparison and heightened exposure to idealized images.
15	Pouwels (2021)	Adolescents' Social Media Experiences and Their Self-Esteem: A Person-Specific Susceptibility Perspective	3-week Experience Sampling Method (ESM) with Dynamic Structural Equation Modeling (DSEM).	300 adolescents Age range: 13–16 years (Mean age = 14.61)	On average, adolescents who spent more time on social media reported slightly lower self-esteem ($\beta = -.14$) compared to peers. However, within individuals over time, social media use did not significantly affect self-esteem overall. Individual responses varied: 27% had negative effects, 18% positive, and 56% little or no effect. The emotional tone of social media experiences predicted self-esteem more strongly than time spent; positive experiences increased self-esteem ($\beta = +.15$), with 78% of adolescents experiencing positive effects. Self-esteem instability and peer approval contingent traits increased sensitivity to social media impacts, while gender and appearance-based contingencies did not moderate the effects. Overall, positive social media experiences outweighed negative ones, contributing more to self-esteem boosts than drops

This review examines the influence of social media use on the mental health of middle school learners, how these dynamics intersect with science education, and what strategies can promote responsible and beneficial engagement. We structure the synthesis below around the guiding research questions and situate the evidence within social learning theory (Bandura, 1977).

Impacts of Social Media Usage on Mental Health of Middle-Level Learners

Across the reviewed studies, one consistent theme is that heavy or unregulated social media use is associated with poorer mental health outcomes, although the magnitude and form of this relationship vary. Evidence from large-scale surveys and meta-analyses shows that time spent online is often linked to depressive symptoms, anxiety, and reduced self-esteem, with risks increased by disrupted sleep, cyberbullying, and negative self-comparisons (Ivie *et al.,* 2020; Kelly *et al.,* 2018; Sampasa-Kanyinga & Lewis, 2015). However, other studies underscore that the effect sizes are modest relative to more powerful predictors such as sleep quality or offline bullying (Orben & Przybylski, 2019). This variability indicates that social media is not inherently harmful; its impact is conditional on usage patterns, individual vulnerabilities, and the broader social environment.

Several patterns warrant closer examination. First, developmental stage was an important theme, where younger adolescents appeared more vulnerable to low self-esteem and negative emotional outcomes than older peers (Sampasa-Kanyinga, et al (2023)). Gender also shaped mental health outcomes; girls are more negatively affected by passive use that fosters appearance-based comparisons, while boys experience more harm through active public posting (Frison *et al.,* 2015; Steinsbekk, 2020). The type of engagement was also shown to be critical, showing that supportive and affirming interactions can boost self-worth, while hostile or comparison-driven exchanges undermine it (Pouwels, 2021). These patterns align with the conceptual framework of mental health as a mediator: social media is a context in which psychological well-being is either strengthened or eroded, with implications for motivation, focus, and resilience in schools.

Importantly, not all effects were negative. Studies documenting positive digital exchanges suggest that

the quality of interaction outweighs the quantity of time online, with adolescents often reporting enhanced self-esteem and social support following constructive engagement (Pouwels, 2021). This suggests that interventions should not only reduce harmful use but also cultivate opportunities for positive connections. Programs that combine digital literacy with social-emotional learning may help adolescents to critically evaluate online content, resist harmful comparisons, and build healthier relationships. Such approaches resonate with Bandura's recognition that learning depends not only on external observation but also on internal states of attention, self-efficacy, and motivation.

Implications of Social Media Usage in The Middle Level Science Classroom

The second research question concerns how these dynamics shape learning outcomes in science. Social learning theory provides a useful interpretive lens. Adolescents learn not only through direct instruction but also by observing and imitating the behaviors modeled by peers, teachers, and, increasingly, digital communities. Social media platforms provide abundant symbolic models, ranging from classmates to influencers, whose behaviors can shape learners' attitudes toward science and school (Sampasa-Kanyinga *et al.,* 2019; Zozaya-Durazo *et al.,* 2023).

The reviewed evidence suggests that mental health is a critical mediator in this process. Students experiencing depression, anxiety, or low self-esteem, often outcomes of problematic social media use, struggle to sustain attention, retain information, and participate actively in class (Gupta *et al.,* 2022; Schmidt, 2020). This disruption weakens the chain of observational learning: although the learner may see a demonstration or hear an explanation, their reduced attention and motivation hinder retention and reproduction. For example, sleep-deprived students who spend nights online may be physically present in science lessons but are cognitively disengaged. Similarly, students burdened by social comparison or cyberbullying may avoid participation for fear of further judgment.

Conversely, positive social media experiences can reinforce learning. Bandura emphasized that behaviors that are observed to be rewarded are more likely to be adopted. When adolescents see peers celebrated for science achievements online or engage with science communicators on platforms they enjoy, their interest and self-efficacy may increase. Moderate and purposeful use, such as participating in online science groups or following educational content, has been associated with greater connectedness and engagement (Durak, 2018; Tomás-Miquel *et al.,* 2015). In this sense, social media can act as an extension of the classroom, amplifying positive reinforcement and making scientific inquiry visible and rewarding for students.

The implications are clear: the impact of social media on science learning is bidirectional and context dependent. Poor mental health, mediated by problematic use, can obstruct the cognitive and emotional processes central to science education. However, balanced and supportive use can enhance engagement, motivation, and the observational learning that underpins scientific inquiry. For educators, the task is not to dismiss social media but to channel it toward academically productive purposes while simultaneously addressing the mental health risks that can derail learning.

Strategies for Responsible and Supportive Social Media Use

The final research question addressed strategies for harnessing the benefits of social media while mitigating risks. The reviewed studies converge on several practical implications. Time regulation is consistently emphasized; adolescents who set boundaries and use platforms purposefully report fewer negative outcomes and a stronger academic focus (Daniel *et al.,* 2025). However, regulation alone is insufficient without critical engagement. Learners require digital literacy skills to filter information, evaluate credibility, and resist harmful comparisons (Janson & Holland, 2024). These skills intersect directly with science education, where evaluating evidence and claims is a central competence.

Teachers have emerged as central agents in shaping responsible use. When science teachers integrate social media into classroom tasks, such as assigning group projects that require online collaboration or encouraging engagement with science content on digital platforms, students report greater motivation and directed learning (Akgunduz & Akinoglu, 2016; Tezci & İcen, 2017). Importantly, teachers can model positive digital behaviors, creating classroom communities that reinforce constructive norms. Research consistently shows that when students feel connected and supported in school, they demonstrate stronger academic outcomes and resilience to negative online influences (Knifsend *et al.,* 2018; Sarwer *et al.,* 2024).

Parents also play pivotal roles. Supervision of online activity, encouragement of constructive use, and open communication about risks can buffer adolescents against harmful effects (Otubue & Oji, 2024). Studies have indicated that family media plans and discussions about online experiences promote healthier habits and reduce stress (Canadian Paediatric Society, 2019). Similarly, school administrators and policymakers can support responsible use through clear guidelines, workshops, and promoting digital well-being initiatives (Bashir & Bhat, 2017). Social networking sites have a role to play in regulating harmful content and enforcing age restrictions.

Aligned with social learning theory, effective strategies not only reduce risks but also leverage observational learning for positive outcomes. Highlighting young role models in science, showcasing student achievements online, or creating school-run platforms that celebrate academic success can harness the same mechanisms that make social media engaging, that is, visibility, peer recognition, and reinforcement, while channeling them

toward educational outcomes (Tchernegovski *et al.,* 2015). This dual approach, which minimizes risks and amplifies benefits, positions social media as a tool that can either hinder or enhance learning, depending on how it is structured and experienced. To draw together the evidence across the three guiding research questions, the synthesized key findings and their implications are summarized in Table 2. This table highlights how social media use and adolescent mental health interact to influence science learning and how targeted strategies can mitigate risks while leveraging potential benefits.

Table 2: Synthesis of findings in relation to the research questions

Research Question	Main Patterns Identified	Implications for Middle-School Science Education
How does social media use influence the mental health of middle school students?	Heavy and unregulated use linked to depression, anxiety, low self-esteem; risks vary by age and gender. Type of use (passive comparison vs. supportive interaction) more decisive than total time. Positive exchanges can build resilience and self-worth.	Interventions should target risky behaviors (e.g., appearance-based comparison), emphasize digital literacy, and support constructive online interactions. Mental health serves as a mediator for learning
What are the implications of social media use for science learning?	Poor mental health disrupts attention, retention, and classroom participation. Positive online models (science influencers, peers celebrated for academic success) can enhance motivation and engagement.	Science learning can be weakened when social media harms mental health but strengthened when platforms provide positive reinforcement. Teachers should use social media to model and reward scientific curiosity.
What strategies promote responsible and mentally healthy social media use?	Effective strategies include time regulation, digital literacy, teacher-led integration of social media into learning, parental supervision, and institutional guidelines. Positive reinforcement of science achievements online is especially powerful.	Coordinated action across teachers, parents, and administrators is needed. Social media can be transformed from a distraction into a tool for scientific engagement and social-emotional growth.

Limitation

This review was limited to peer-reviewed articles focusing on middle school learners, excluding studies on high school, college, and university students. While this strengthens the developmental focus, it restricts its generalizability. Only publications from 2015 onward were included, which may have excluded earlier but still relevant studies. Therefore, the findings apply most directly to contemporary middle-level contexts and should be interpreted with these boundaries in mind.

CONCLUSION

Taken together, the evidence indicates that social media is neither uniformly harmful nor beneficial. Its impact on middle-level learners' mental health and science education is shaped by the type of engagement, developmental stage, gender, and surrounding support. Social learning theory clarifies why these outcomes matter: adolescents are constantly observing and modeling behaviors online, but their ability to translate these into constructive learning depends on their mental health. Educators, parents, and policymakers can shape this environment by fostering positive reinforcement, regulating harmful content, and integrating social media into pedagogy in ways that support emotional well-being and academic growth. In science education, the task is not to remove social media from learners' lives but to cultivate practices that turn it into a tool for curiosity, resilience, and deeper engagement with scientific ideas.

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